Air Force Civil Engineer Center

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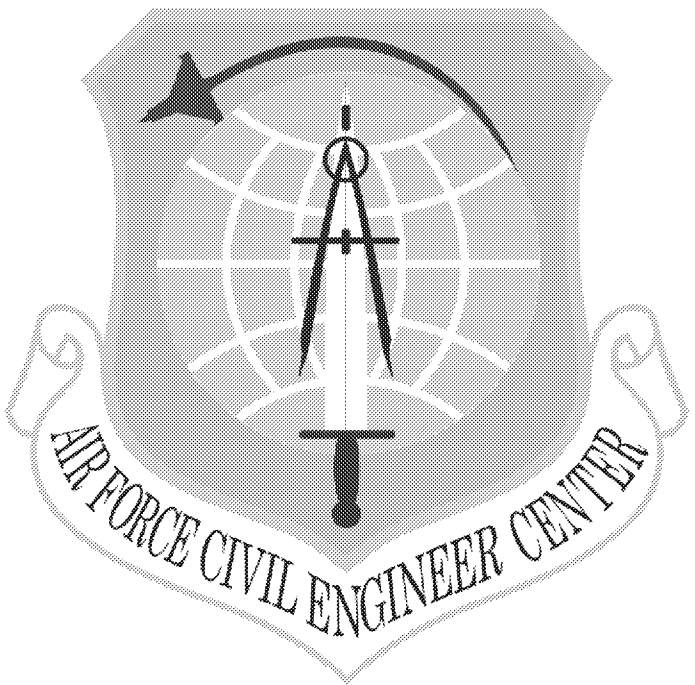


FORMER
WILLIAMS AIR FORCE BASE

Site ST012
Former Liquid Fuels Storage Area Remedial Action

BRAC Cleanup Team Call
19 May 2016

Site ST012 Update

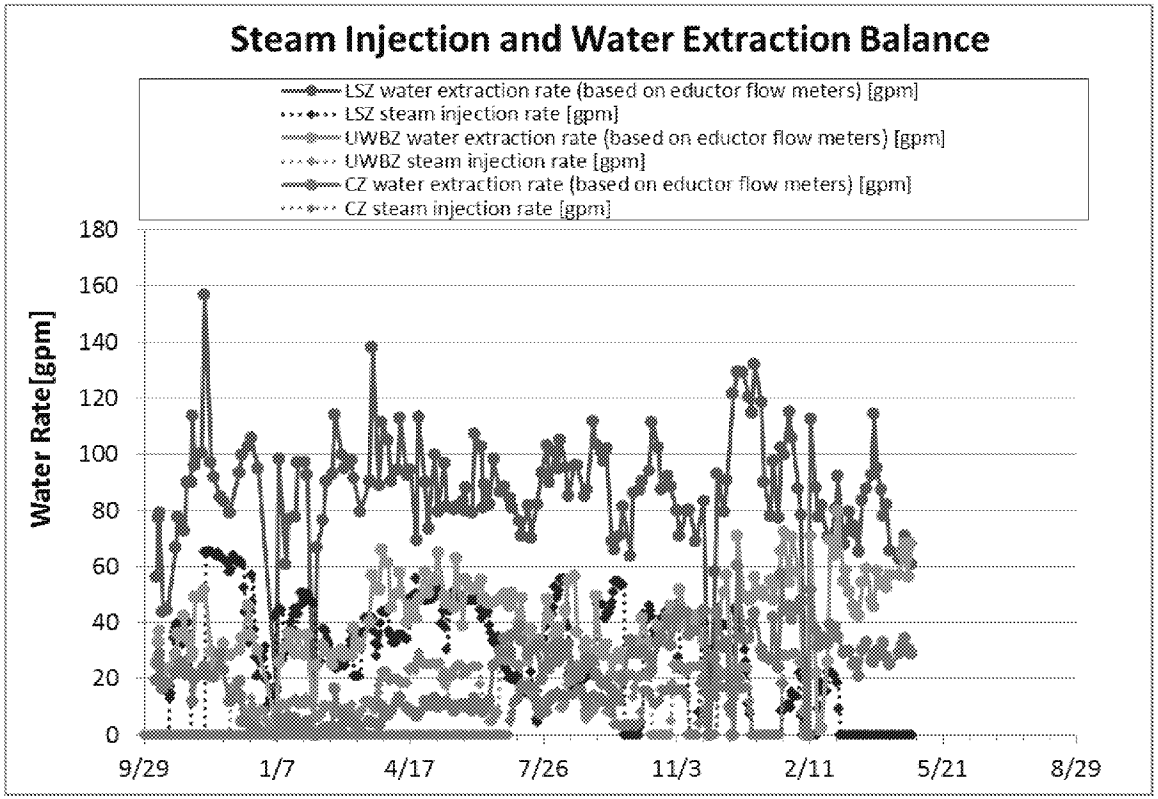
- Steam Enhanced Extraction (SEE) Operation Summary
- Post SEE Decommissioning/Enhanced Bioremediation (EBR) Construction Activities
- Conceptual Long-Term EBR Schedule

SEE System Operation Summary

Site ST012 SEE System Status Summary (through 29 April)

	Value	Unit
Target Treatment Zone (TTZ) Soil Volume	410,000	cubic yards (cy)
Area	199,000	square feet (ft^2)
Upper Depth of Treatment	145	feet (ft) below ground surface (bgs)
Lower Depth of Treatment	245	ft bgs
Vapor Liquid Treatment Started	09/29/14	
Thermal Operations Started	09/29/14	
Last Process Data Update	04/29/16	
Last Temperature Data Update	04/29/16	
Estimated Total Days of Operation	422	days
Days of Operation	578	days
Days of Operation vs. Estimate	137	percent (%)
Estimated Total Energy Usage	11,343,000	kilowatt hours (kWh)
Total Energy Used	6,025,716	kWh
Used Electrical Energy vs. Estimate	53	%
Total Steam Injected	302.4	million pounds (lbs)
Projected Total Steam Injection	320	million lbs
Steam Injected Vs Projected	94	%
Total Mass Removed in Vapor Based on Photoionization Detector (PID) Readings	1,257,290	lbs
Total Mass Removed as NAPL	1,391,026	lbs
Average Daily NAPL Mass Removal Last Week	0	lbs/day
Total Vapor and Liquid Mass Removal (based on PID readings)	2,648,316	lbs
Average Power Usage Rate Last Week	439	kilowatts (kW)
Average Wellfield Vapor Extraction Rate Last	350	standard cubic feet per minute (scfm)
Average Condensate Production Rate Last Week	0.2	gallons per minute (gpm)
Average Water Extraction Rate Last Week	132	gpm
Total Water Extracted	95,827,197	gallons
Total Recovered Light Non-Aqueous Phase Liquid	211,724	gallons
Average Water Discharge Rate Last Week	151	gpm
Total Treated Water Discharge	126,079,000	gallons

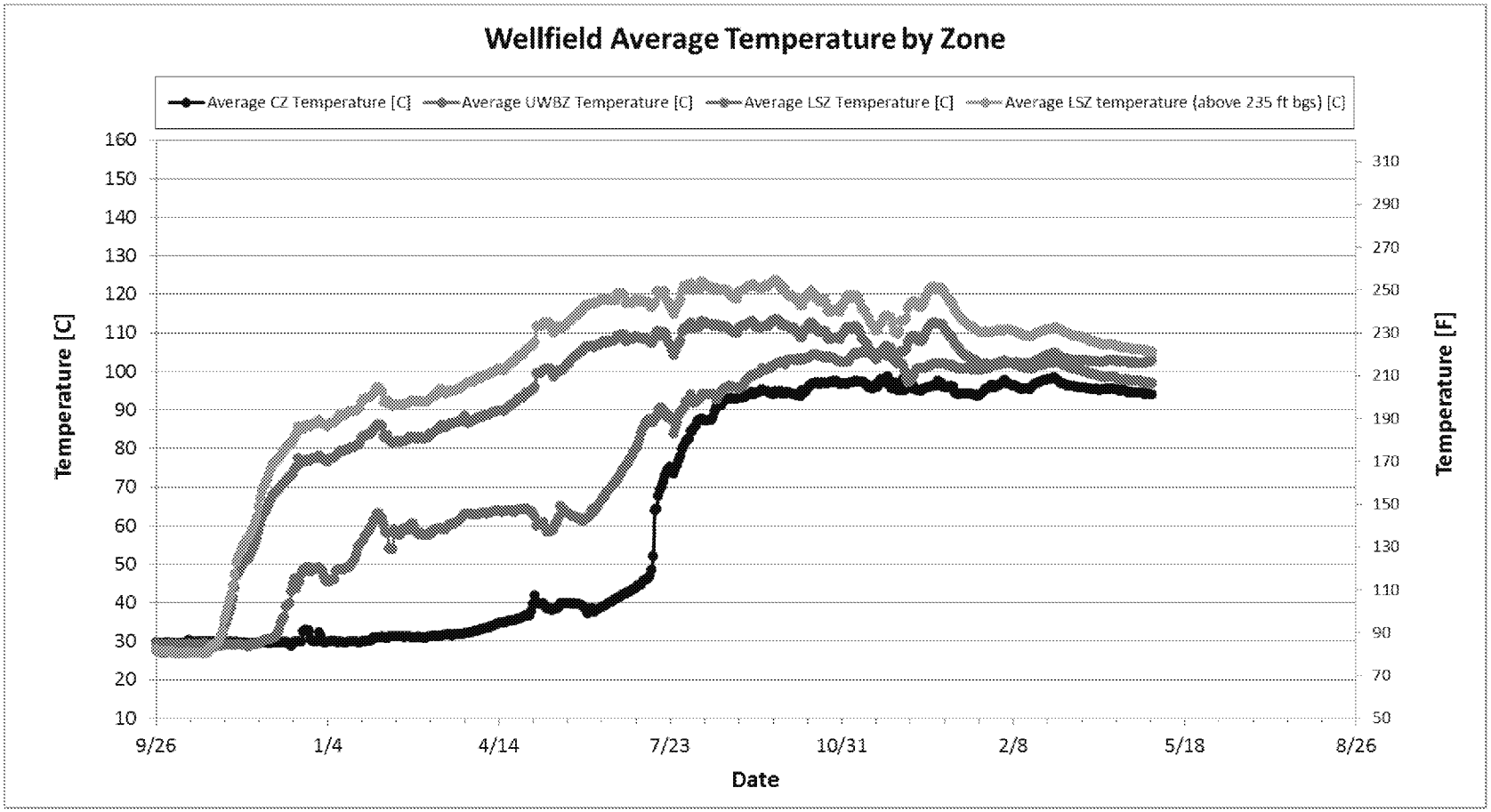
Site ST012 SEE System Injection/Extraction Balance



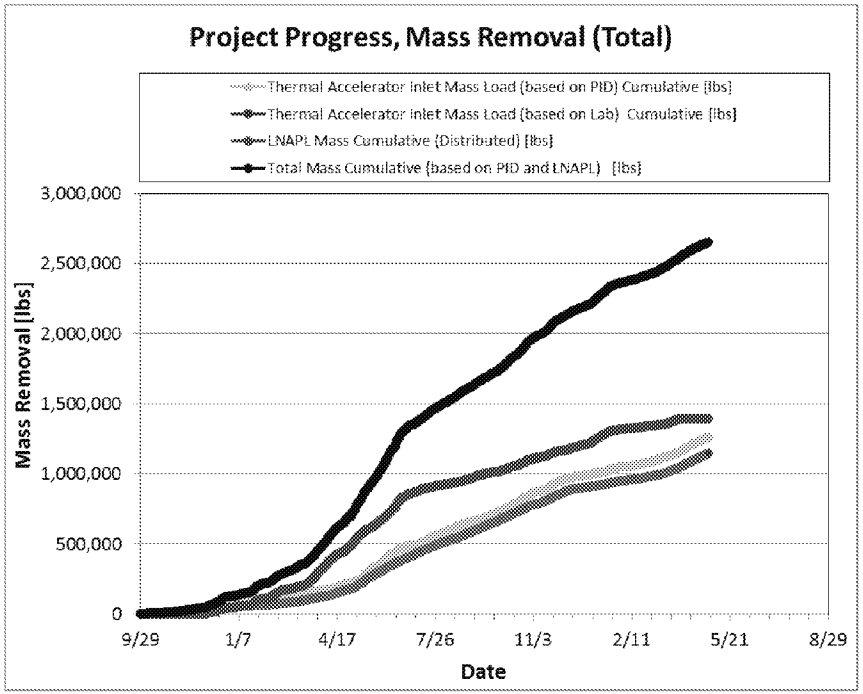
	CZ [gallons]	UWBZ [gallons]	LSZ [gallons]
Water extracted to date	17,406,000	32,916,000	69,964,000
Water injected to date	3,885,000	9,890,000	22,542,000
Net extraction	13,521,000	23,026,000	47,422,000

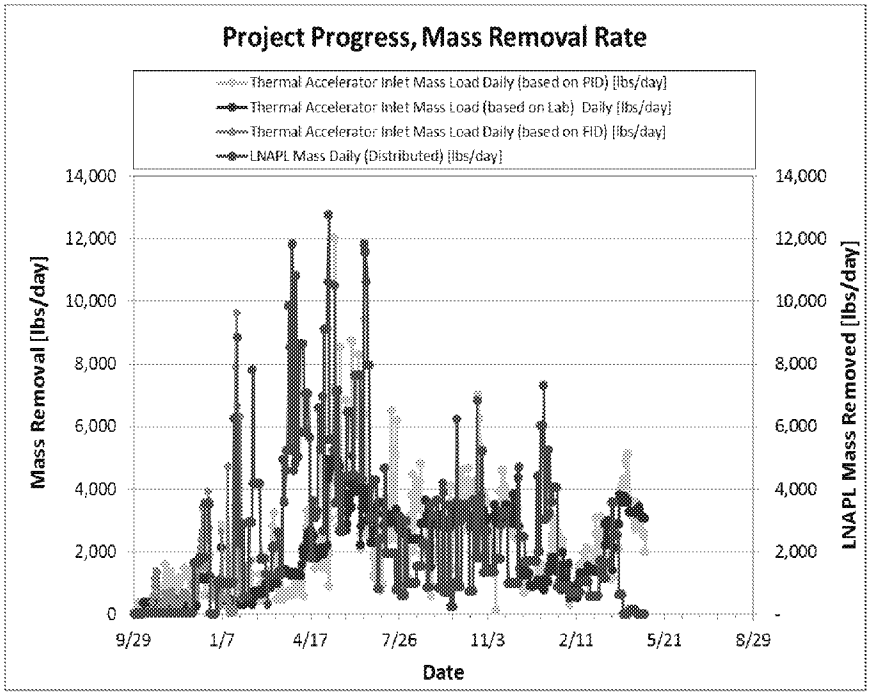
Note: water extracted per zone is based on individual eductor meters

Average Soil Temperatures



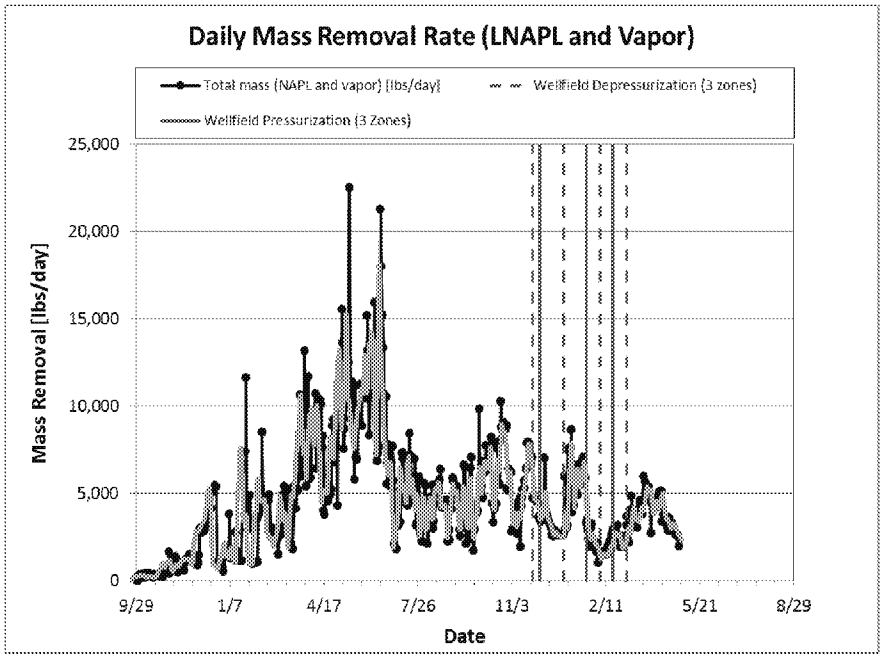
Site ST012 SEE System Mass Removal

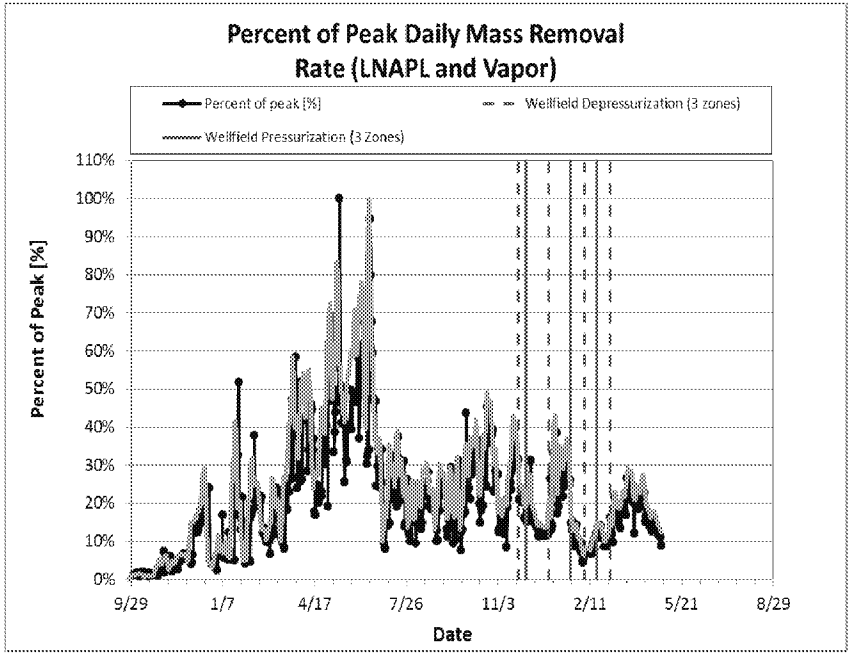




- **Total Contaminant Mass Removal: 2,648,316 lbs recovered**
- **An estimated 1,391,026 lbs (211,724 gallons) as non-aqueous phase liquid (NAPL)**
- **An estimated 1,257,290 lbs of mass (PID) removed in the vapor phase**

Site ST012 SEE System
Daily Mass Removal – Total

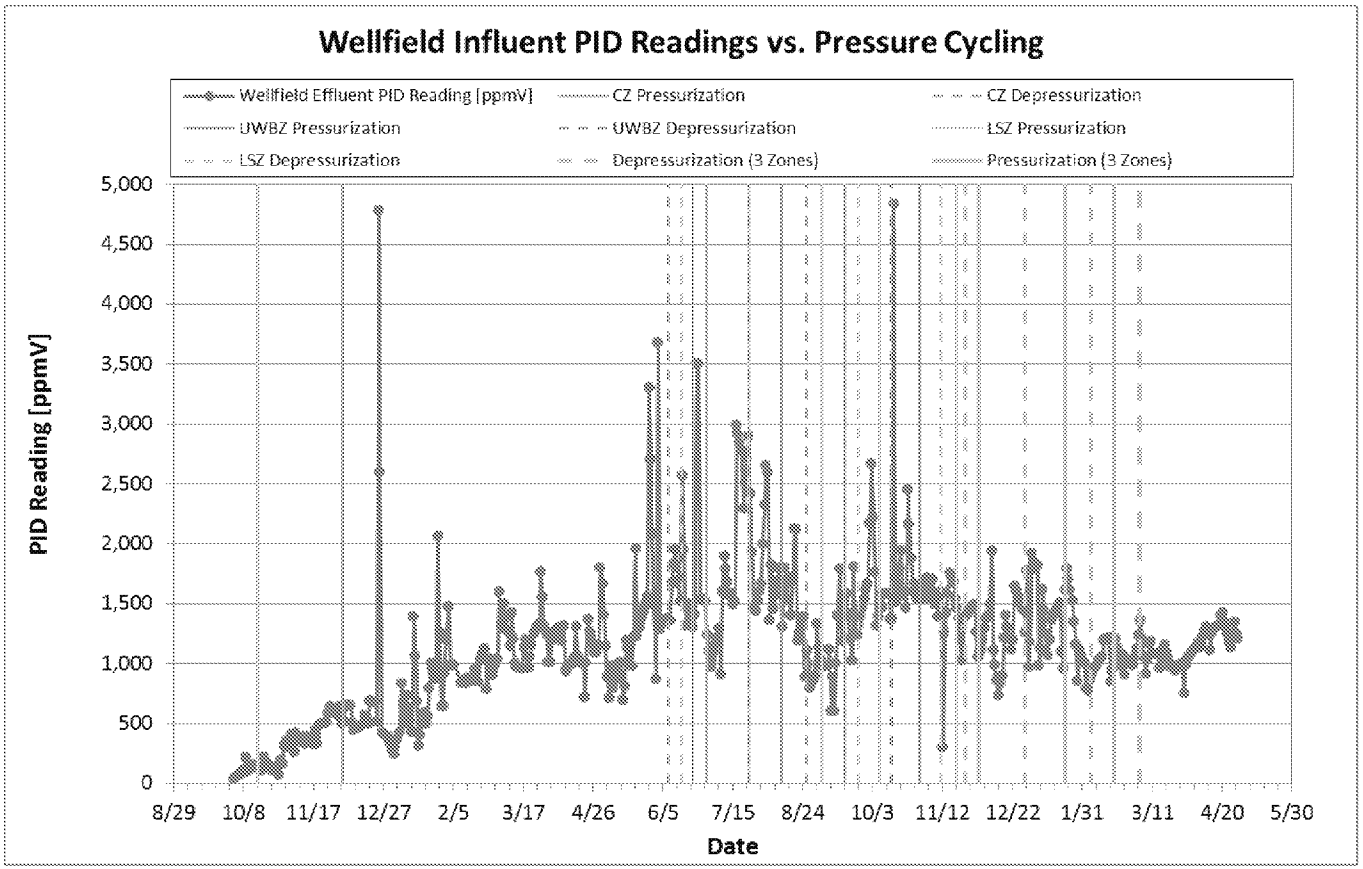




- **Mass removal peaked on 14 May 2015 at 22,506 lbs/day**
- **Total mass recovery averaged 12.8% of peak between 19 April and 29 April, 2016; this equates to 2,881 lbs/day entirely attributable to vapor phase removal**
- **Using a 3-day running average (green trendline) increases the average total mass recovery between 19 April and 29 April, 2016 to 15.8% of peak**

Pressure Cycling and Vapor Concentrations Over Time

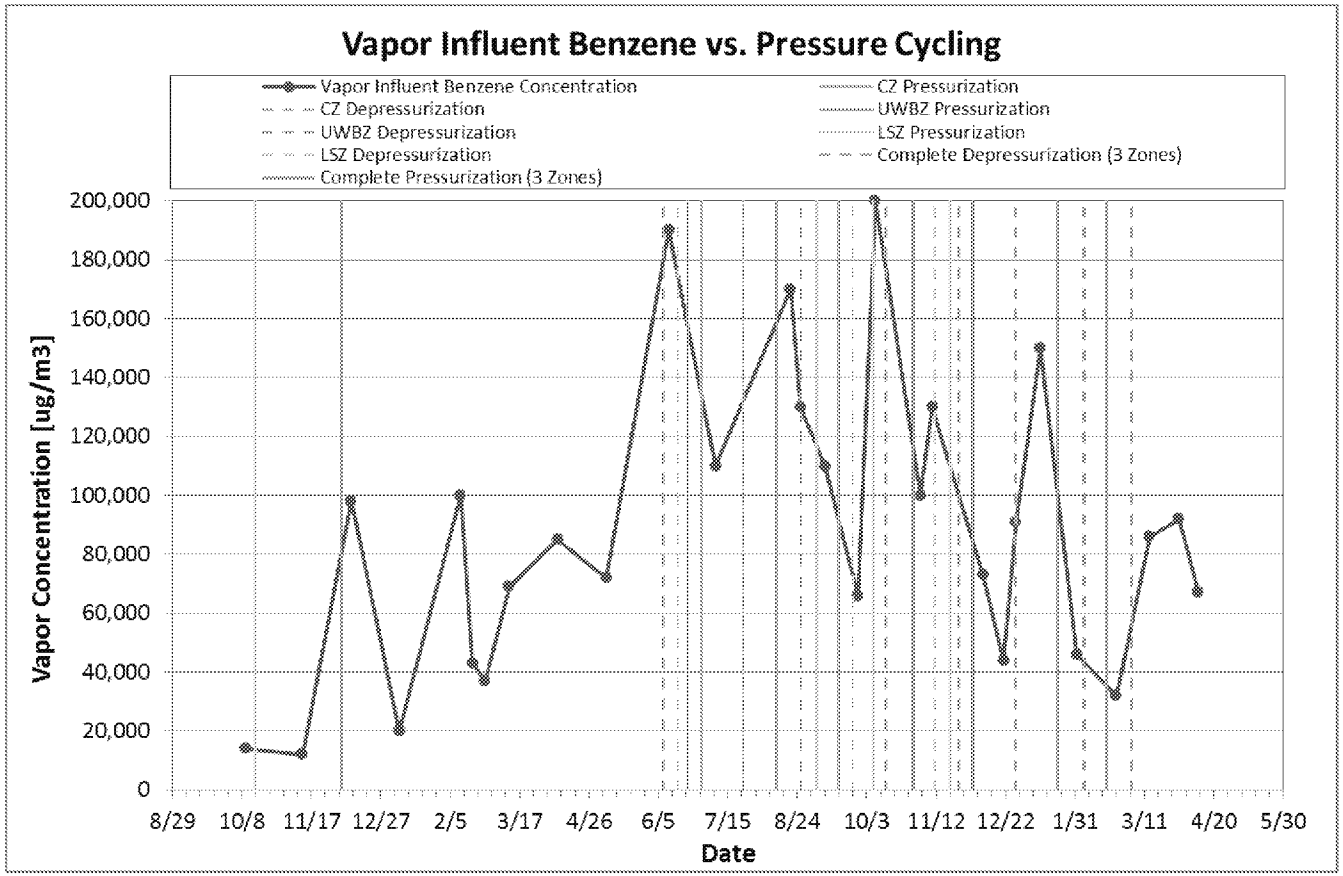
Wellfield Vapor Influent PID Concentrations over Time



- **Wellfield PID concentrations remained relatively stable during site-wide pressurization and depressurization events**

Pressure Cycling and Benzene Vapor Concentrations Over Time

Extracted Vapor Benzene Concentrations over Time
(measured at thermal accelerator influent [includes air stripper effluent] by EPA Method TO-15)

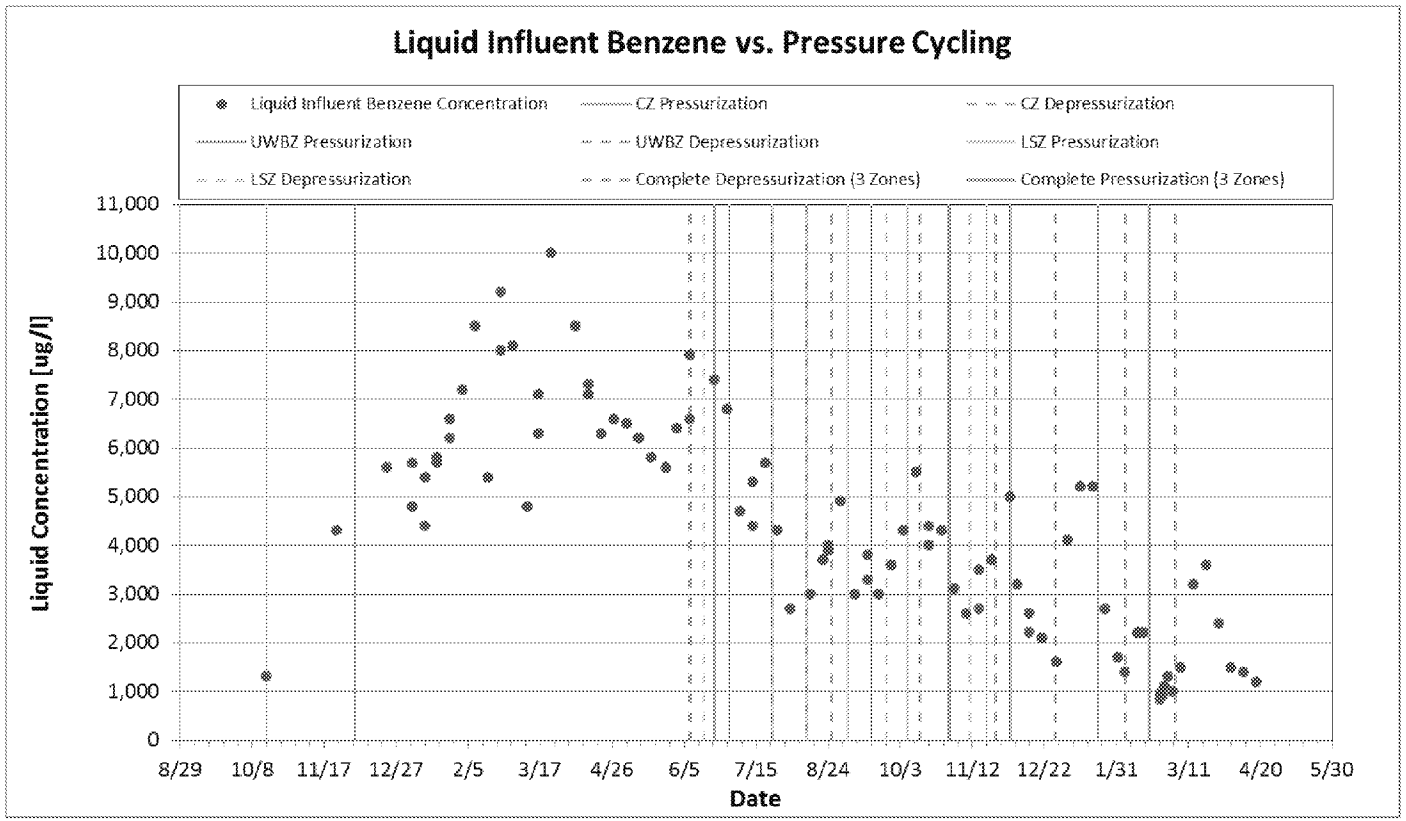


- **Benzene concentrations fluctuated during pressure cycling**

Please note: Final laboratory reports have not yet been issued for vapor sample results collected on 27 April, 2016.

Pressure Cycling and Benzene Liquid Concentration Over Time

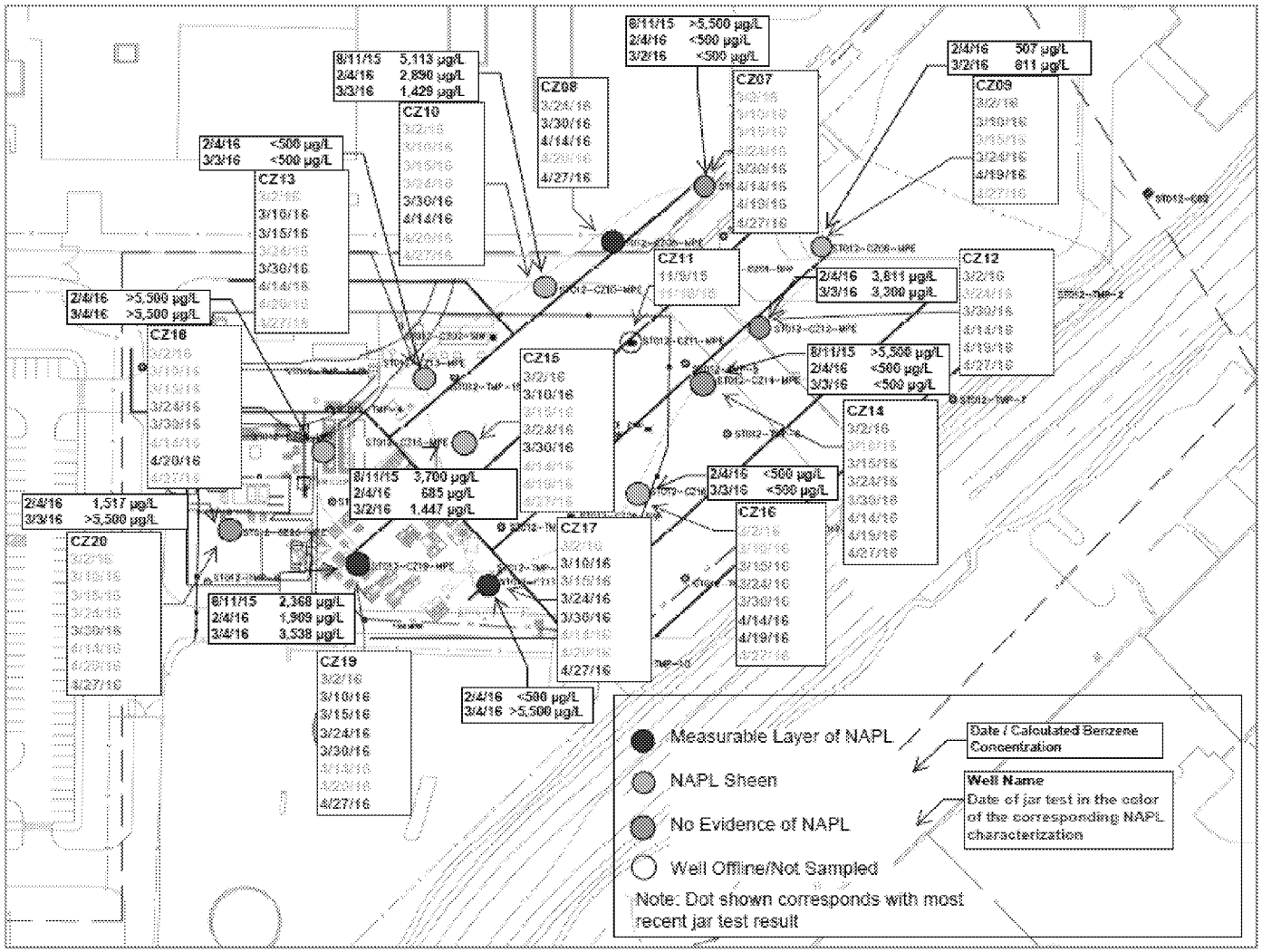
Extracted Liquid Benzene Concentrations over Time (measured at air stripper influent by EPA Method 8260B)



- **Benzene concentrations approached pre-heating concentrations at end of SEE operation**

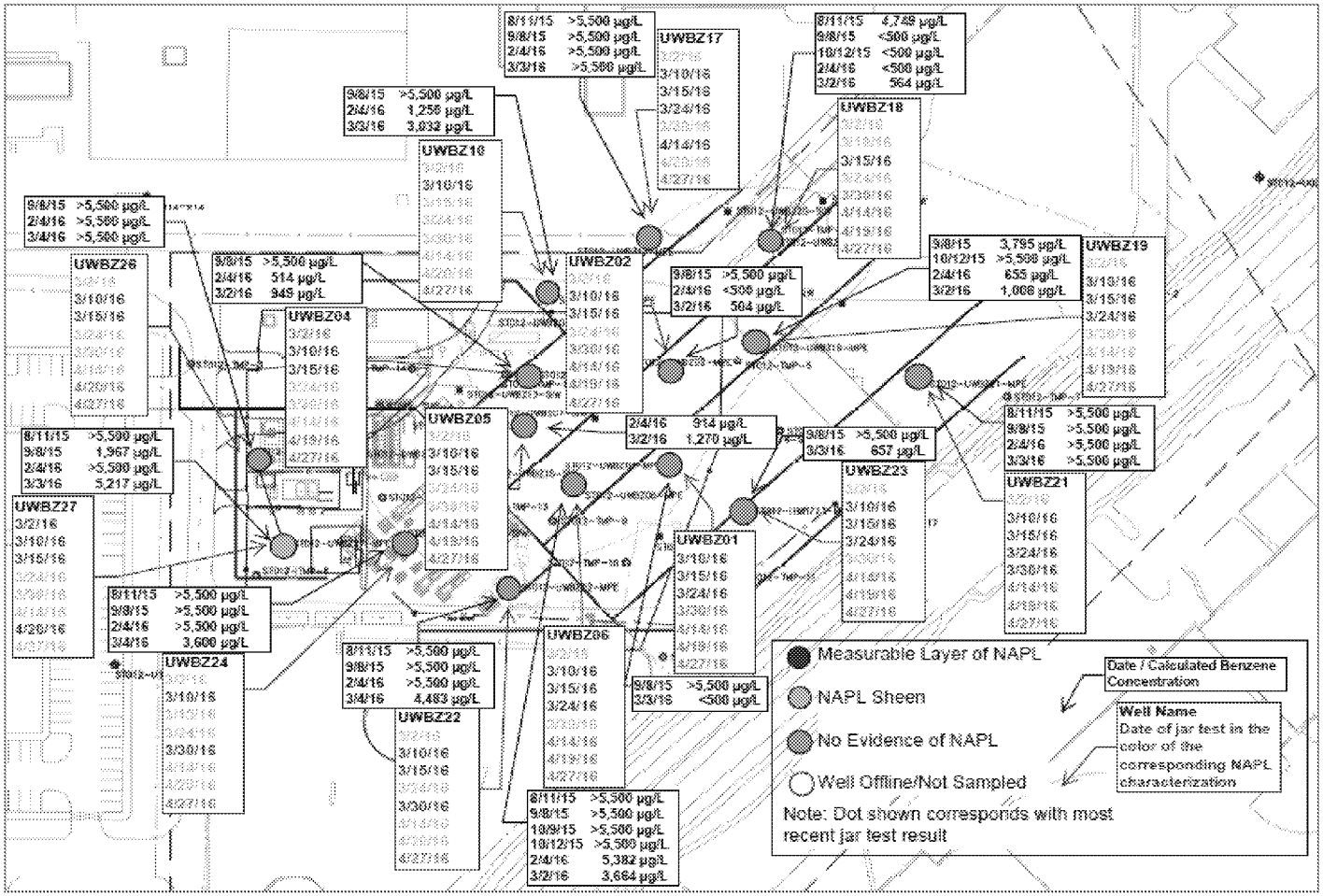
Please note: Final laboratory reports have not yet been issued for liquid sample results collected on 25 April, 2016.

NAPL Screening Results and Calculated Benzene Concentrations – Cobble Zone August 2015 – April 2016



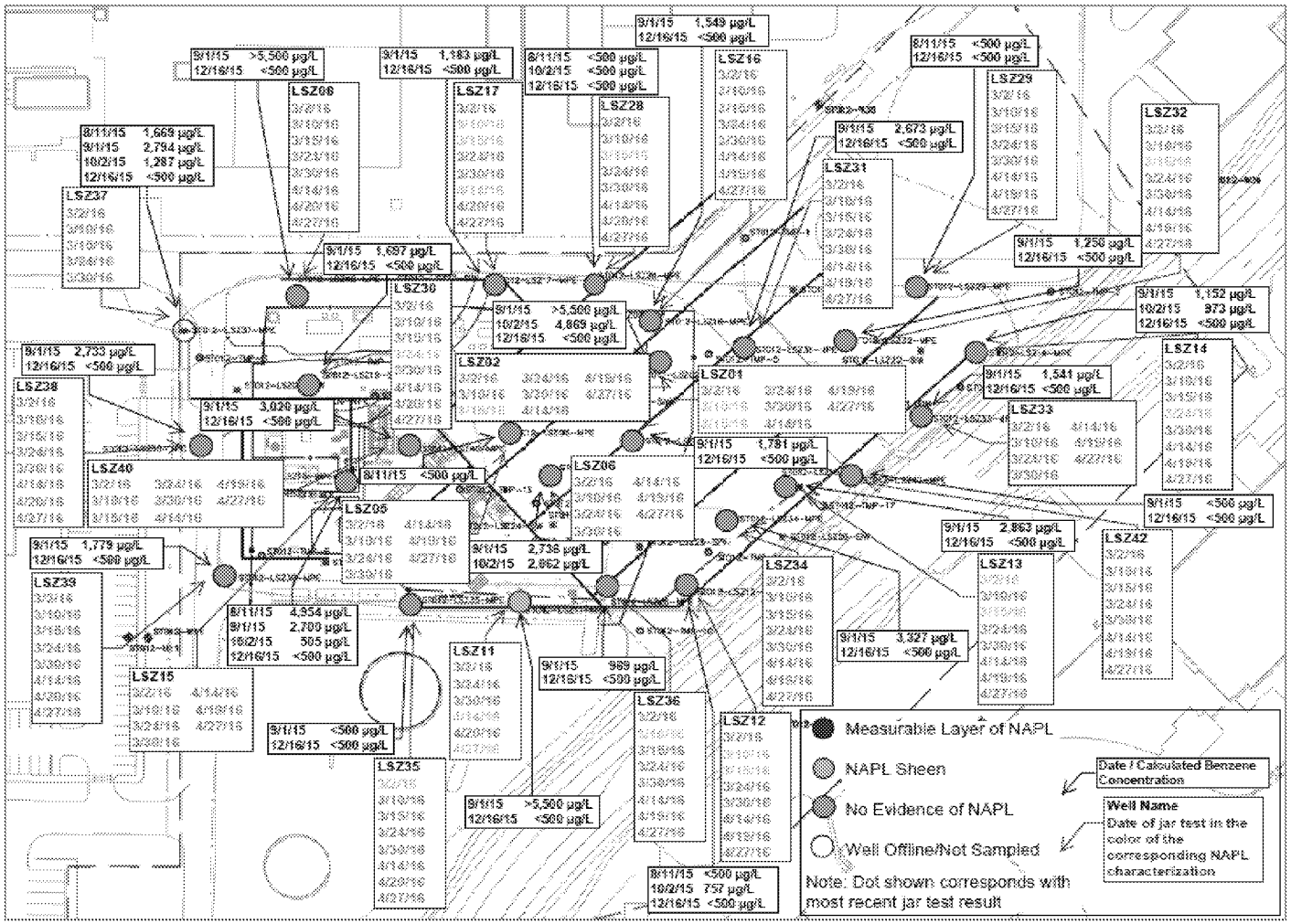
- **NAPL screening results showed continued NAPL presence at end of SEE operation**

NAPL Screening Results and Calculated Benzene Concentrations – Upper Water Bearing Zone August 2015 – April 2016



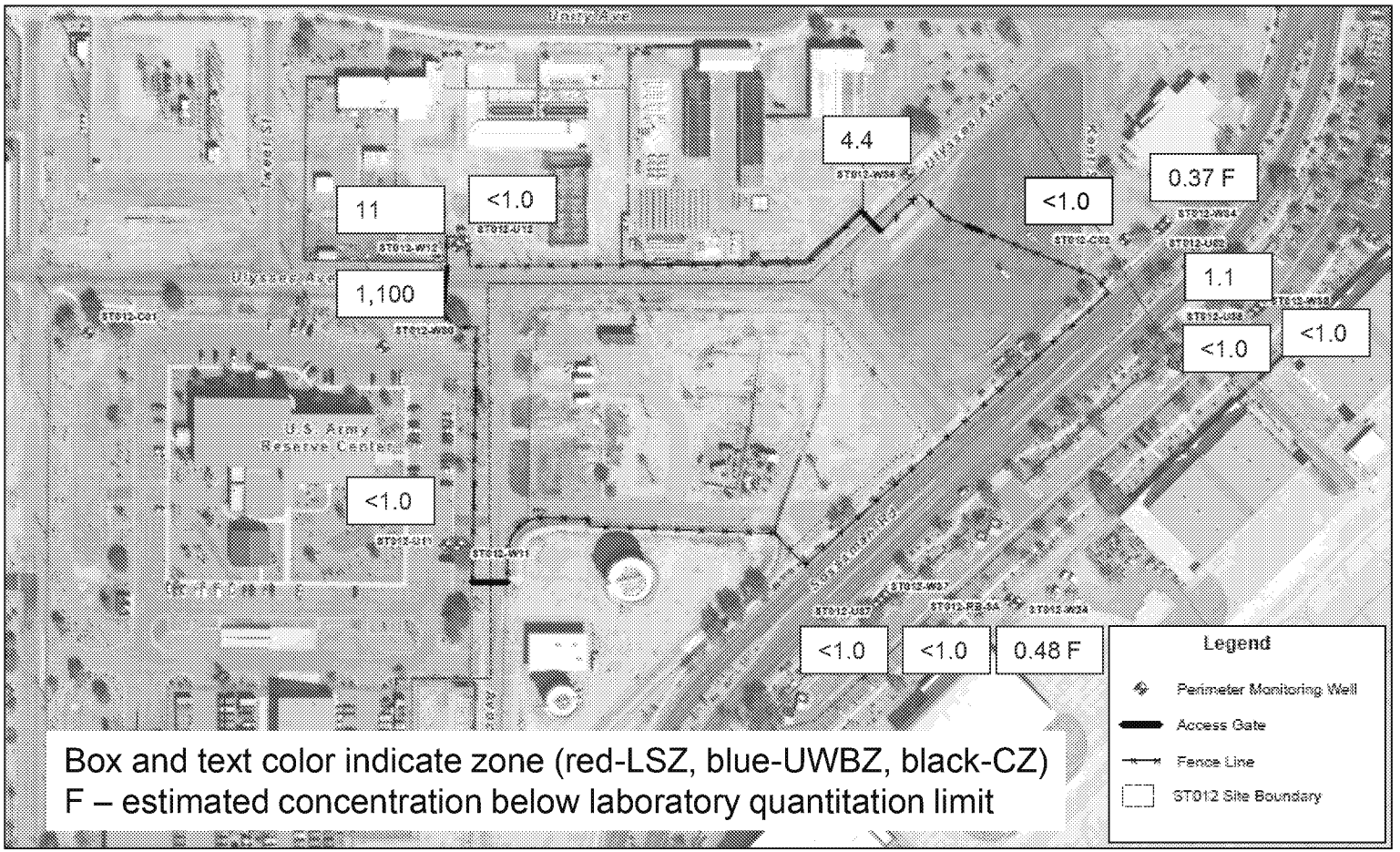
- NAPL screening results showed significant decrease (one location with NAPL sheen) at end of SEE operation

NAPL Screening Results and Calculated Benzene Concentrations – Lower Saturated Zone August 2015 – April 2016



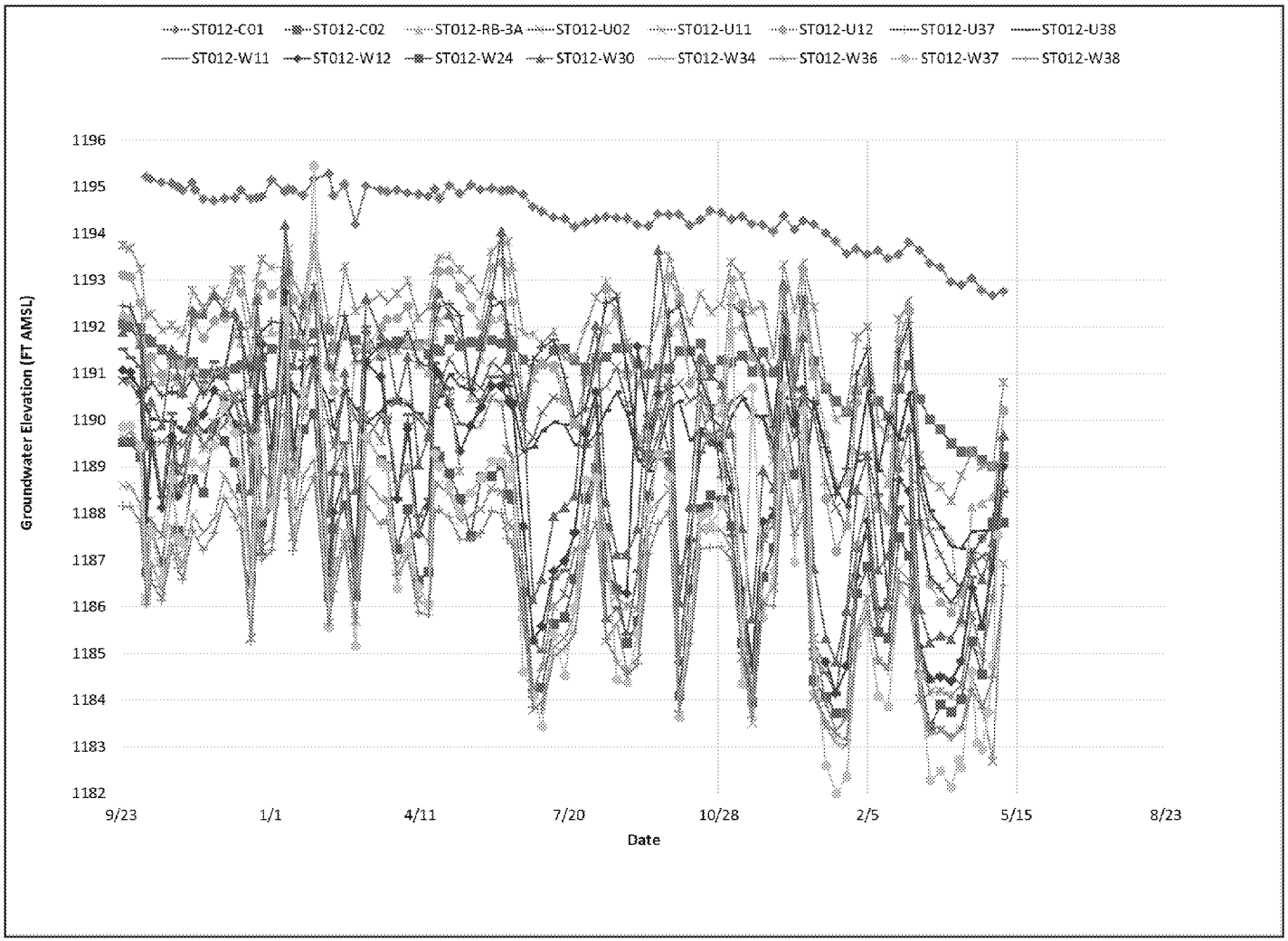
- **NAPL screening results showed sheen at one location at end of SEE operation**

Site ST012 Preliminary April Perimeter Benzene Concentrations (µg/L)

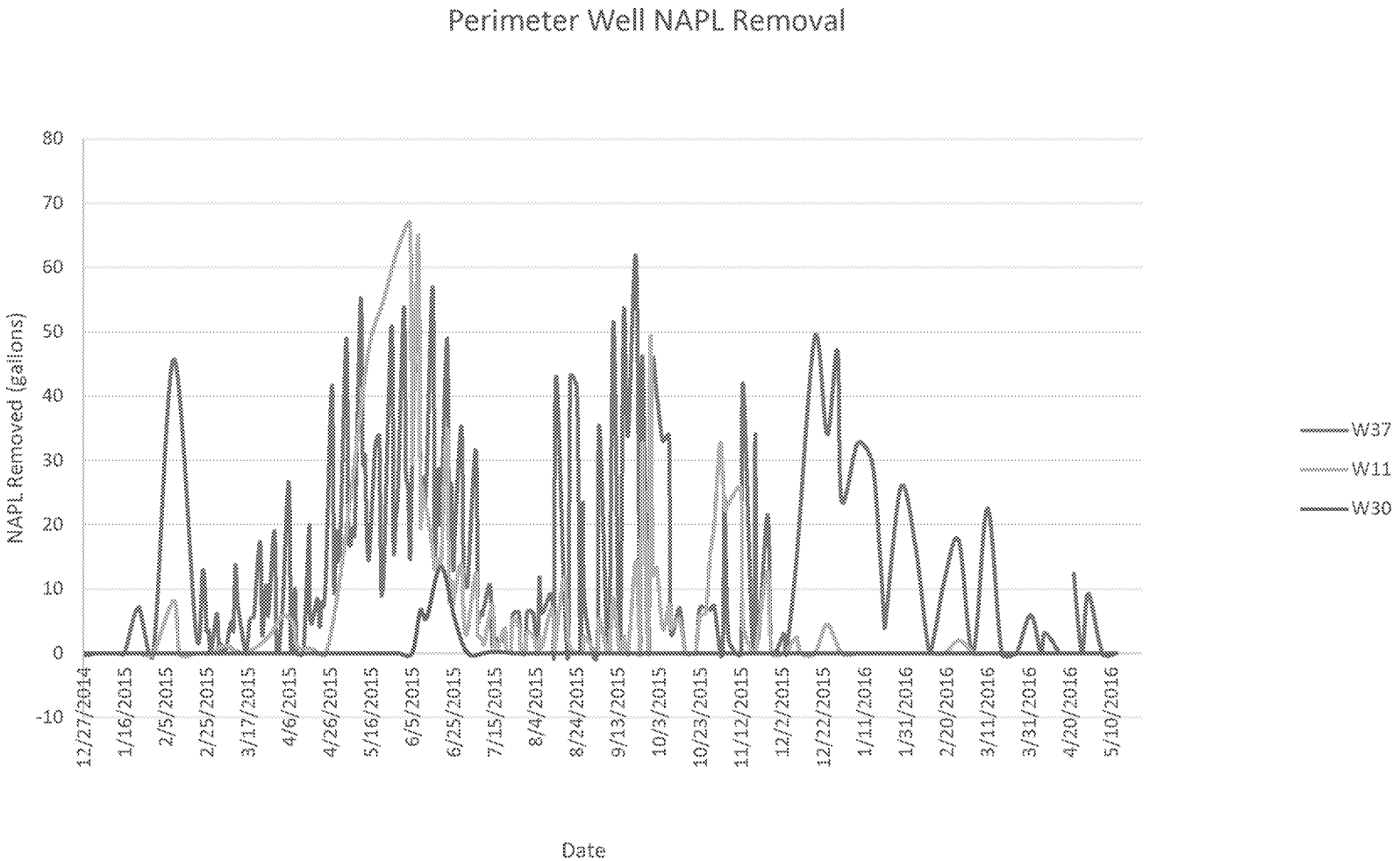


- **Benzene concentration at downgradient locations were below MCLs in April**

Site ST012 SEE Perimeter Groundwater Elevations



Site ST012 SEE Perimeter LNAPL



Post SEE Decommissioning/EBR Construction Activities

Site ST012 SEE Decommissioning

- Cleanout of front end weir tanks, oil water separators, and eductor feed tank (sediment, biomass, etc.) completed on 3 May 2016
- Removal of steam boilers completed on 5 May 2016
- Decontamination of eductor loops and treatment units (triple rinse) completed on 16 May 2016
- Removal of above-ground piping underway
- Removal of weir tanks underway
- Begin removal of SEE well components for access to perform monitoring/sampling
- Tentative date for reopen of Ulysses Ave is 15 Jun 2016

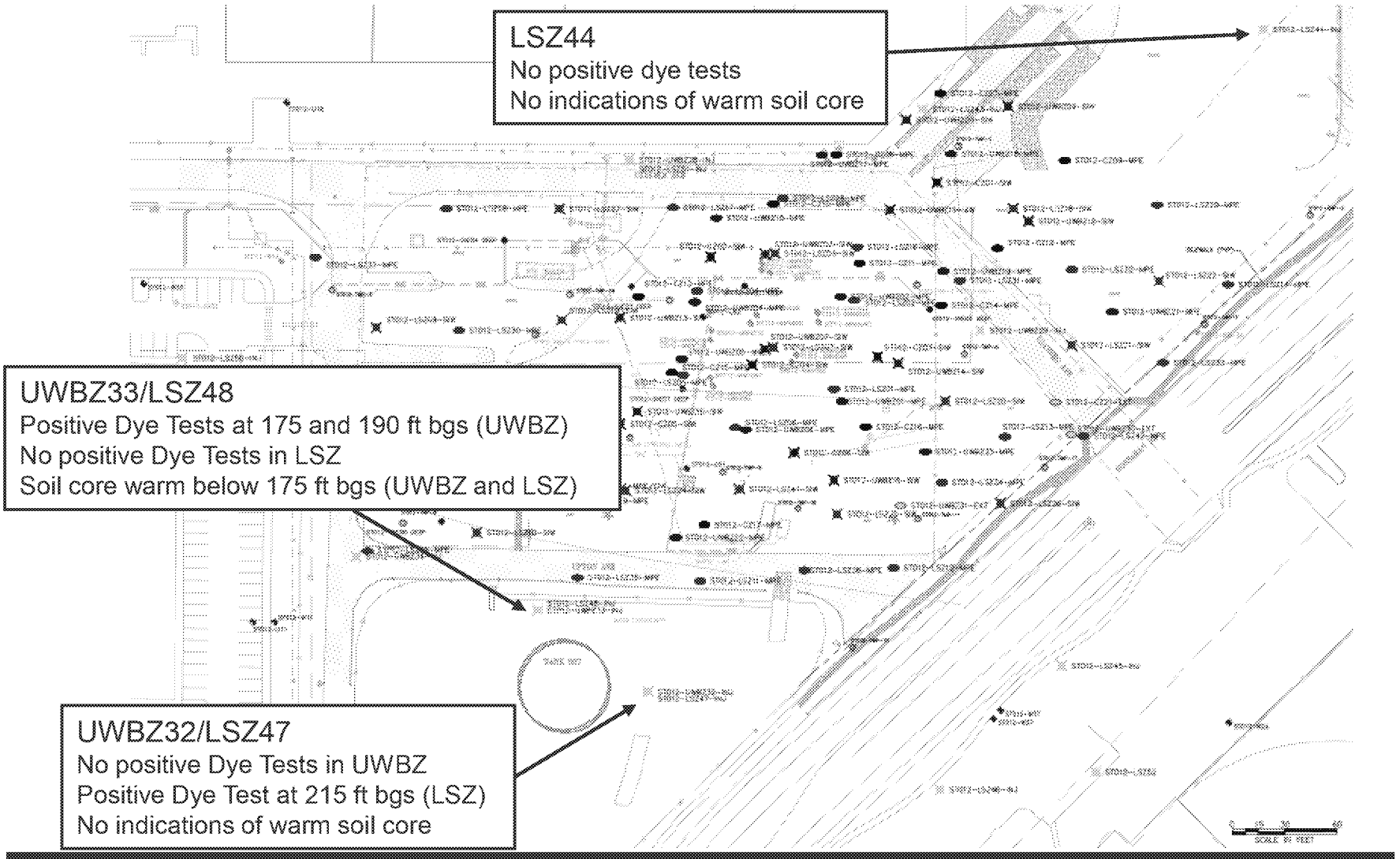
Site ST012 EBR Construction

- Drilling started (details provided later in presentation)
- Deep SVE wells to be reconnected to SVE system by 20 May 2016 (details on later slide)
- Catalyst removed from SVE oxidizer to process higher contaminant load
- SEE wells in process of being screened for NAPL (details on later slide)
- Baseline sampling of SEE wells scheduled for week of 23 May 2016 (details on later slide)
- Perimeter well sampling scheduled for week of 23 May 2016

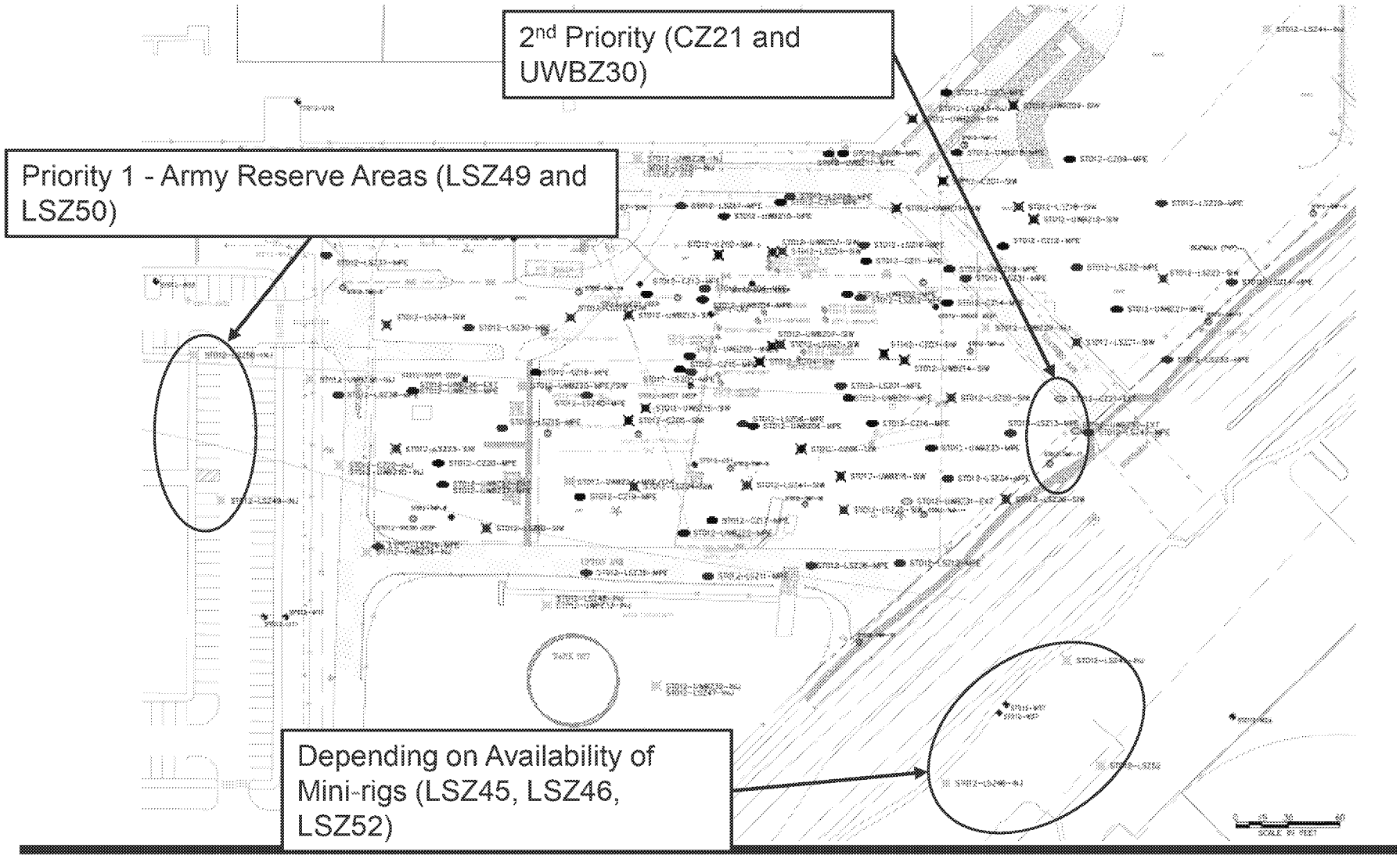
Site ST012 EBR Construction

- Trenching Across Ulysses Ave in process
- Sample newly installed wells in Jun 2016
- Set up EBR treatment system, install well pumps and piping, connect electrical systems Jun to Jul 2016
- Commission system and start extraction in Aug 2016

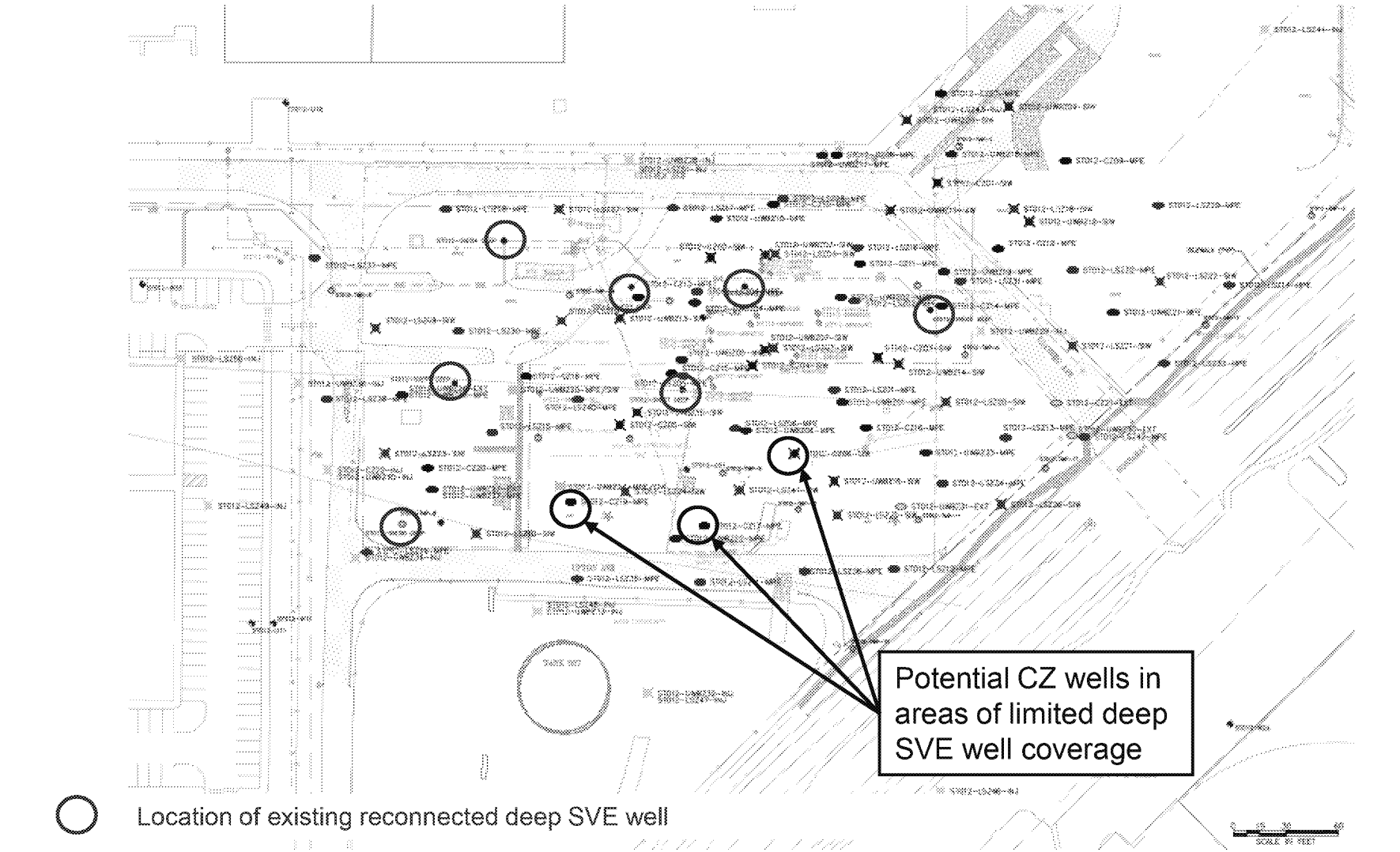
Site ST012 EBR Drilling
First Shift



Site ST012 EBR Drilling Second Shift Plan



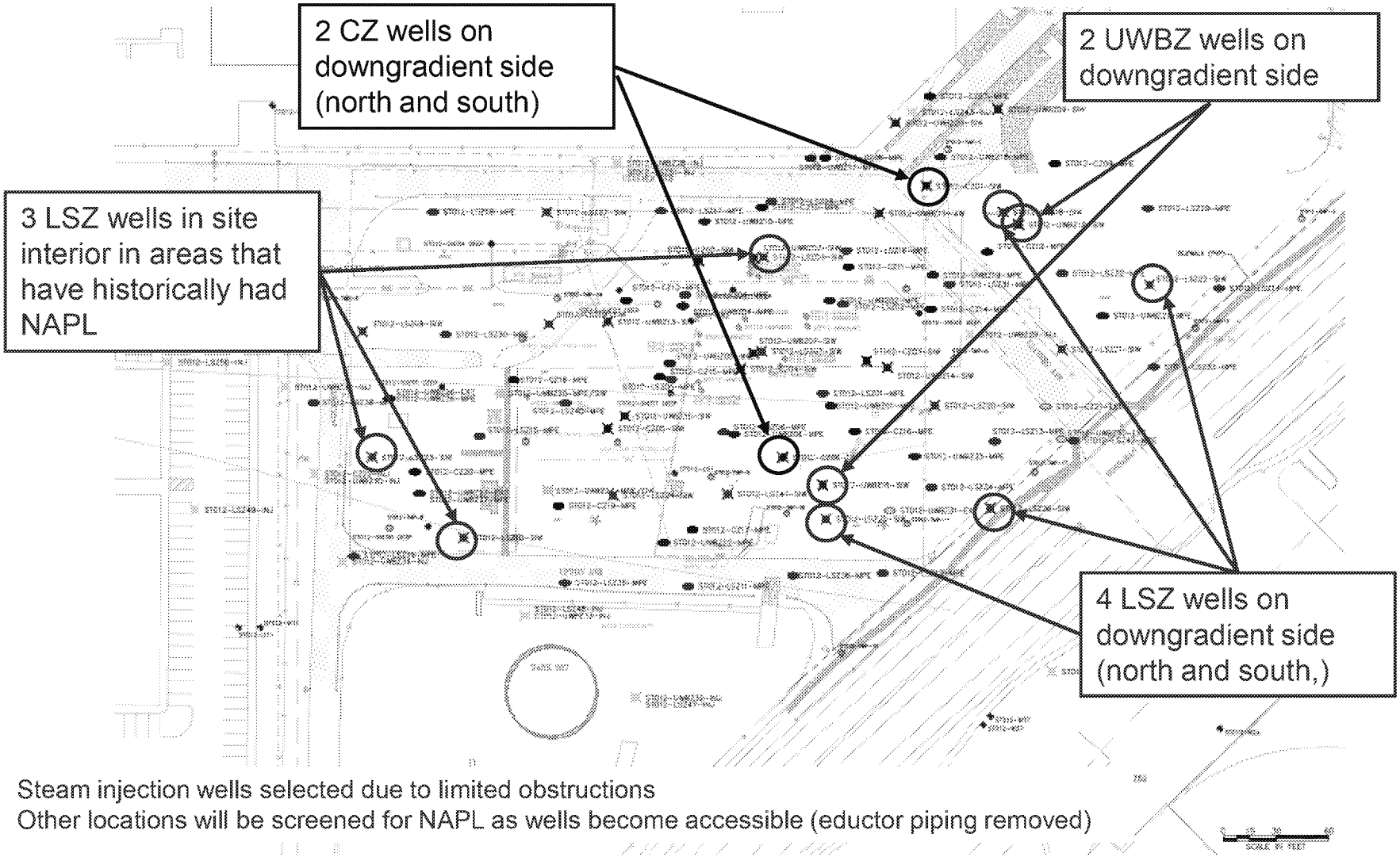
Site ST012 SVE Well Connections



Site ST012 Transition Period Monitoring

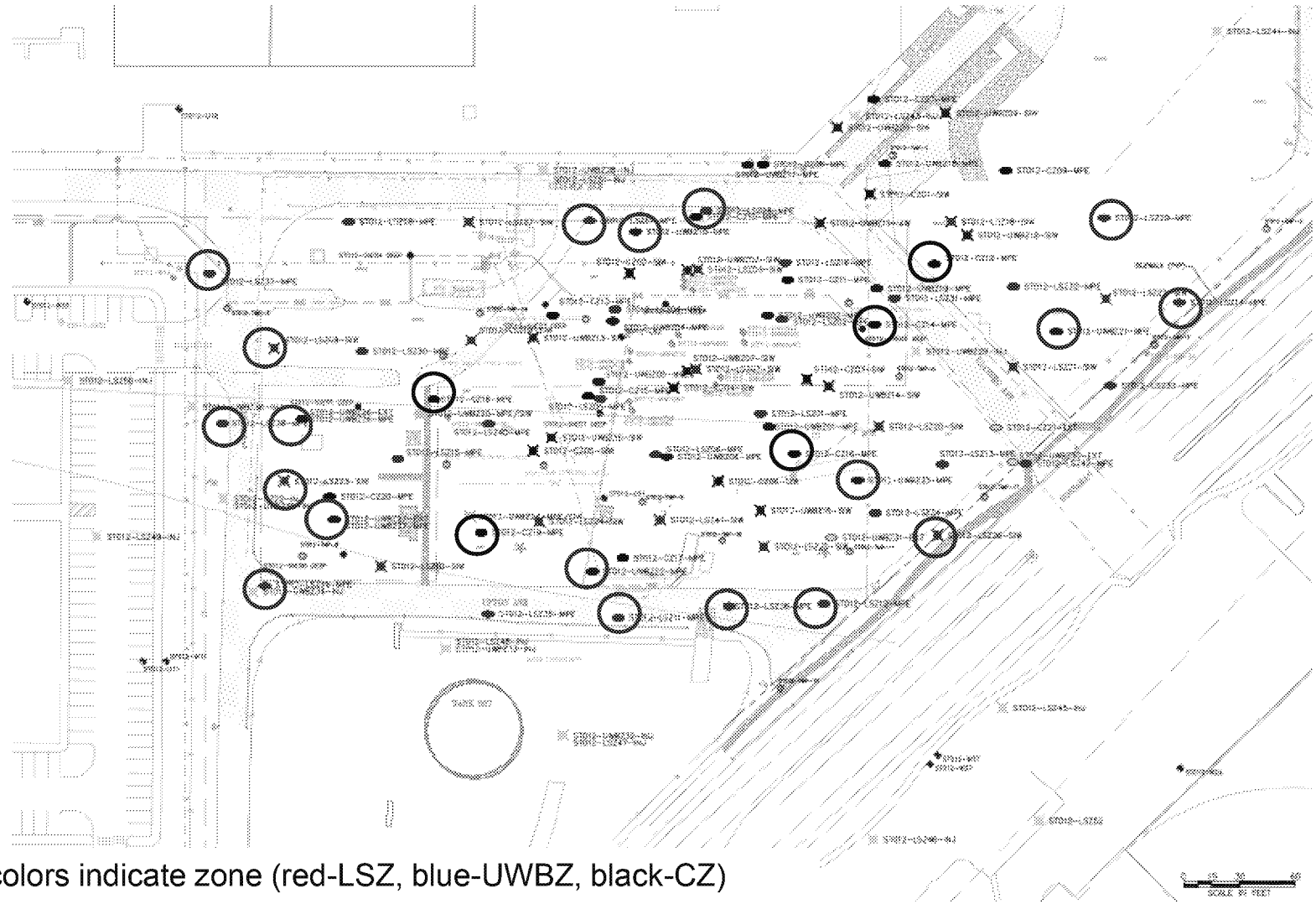
- SEE wells will be assessed and monitored for NAPL following SEE component removal
- May/Jun - Baseline groundwater sampling of SEE wells
- Ongoing perimeter sampling (monthly during transition) and weekly LNAPL monitoring/removal (to include any SEE wells with LNAPL)
- Jun - Newly installed well sampling

Site ST012 Prioritized Locations for May LNAPL Screening



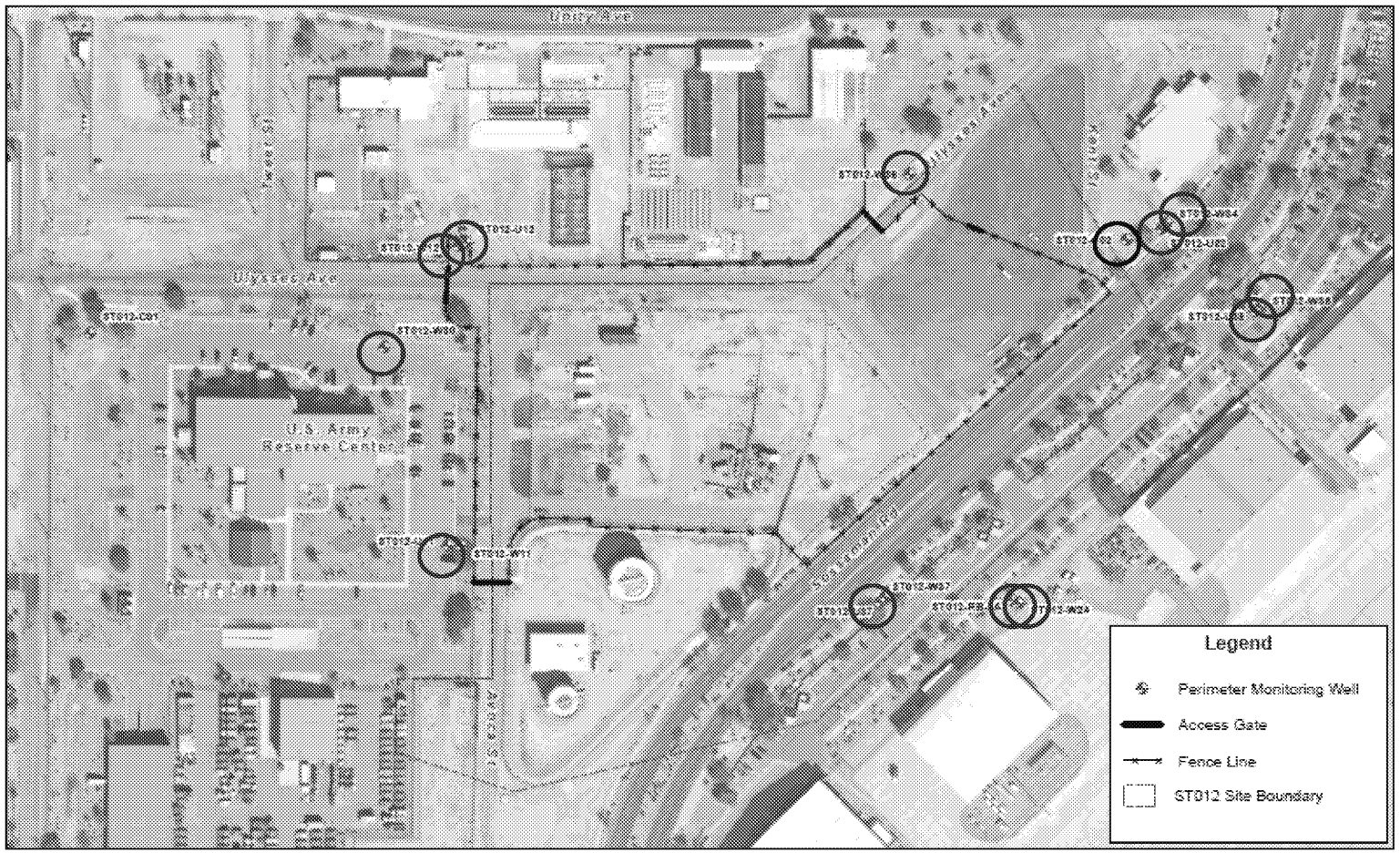
Steam injection wells selected due to limited obstructions
Other locations will be screened for NAPL as wells become accessible (eductor piping removed)

Site ST012
June EBR Baseline Sampling Locations



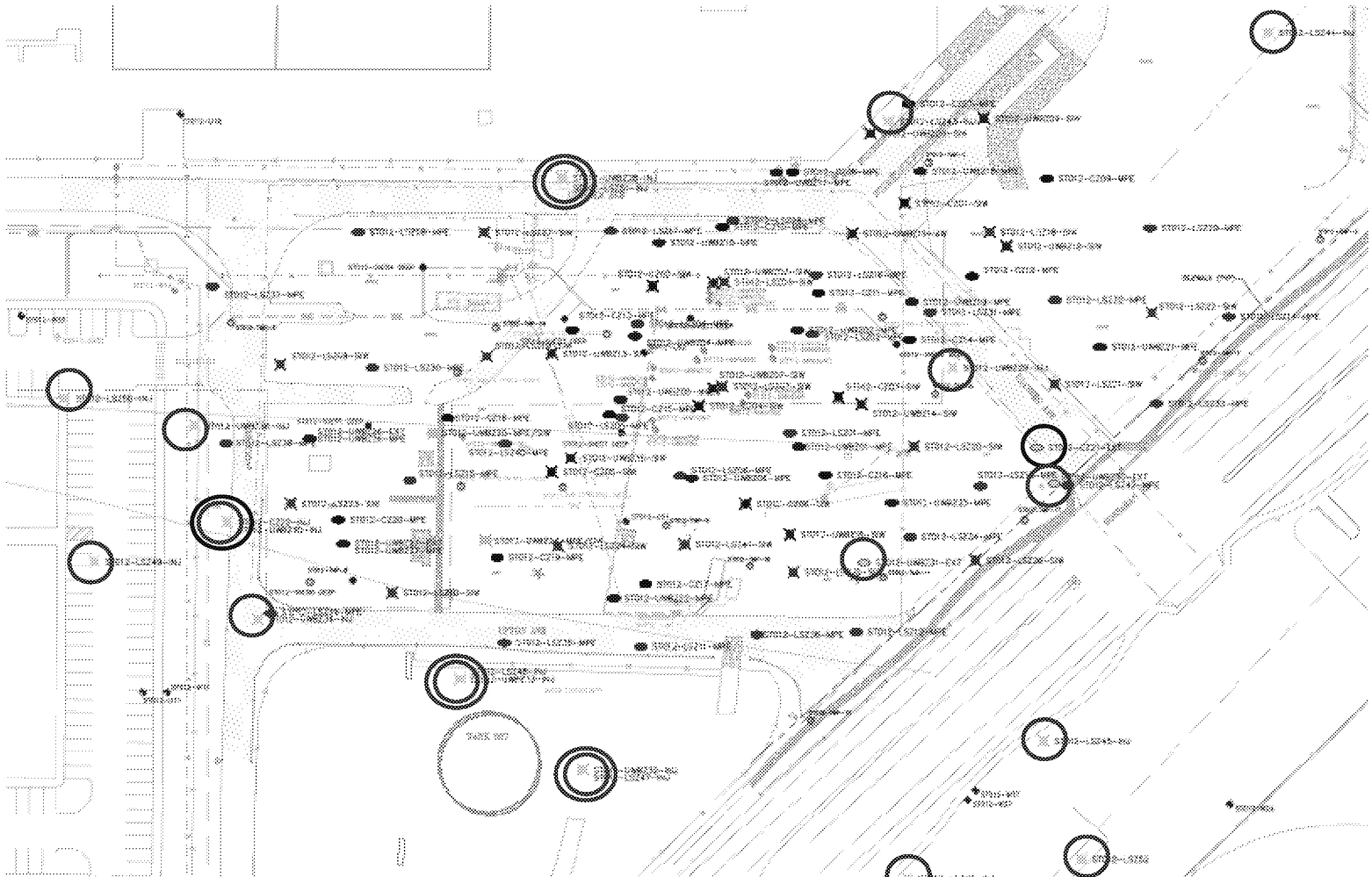
Circle colors indicate zone (red-LSZ, blue-UWBZ, black-CZ)

Site ST012
May Perimeter Well Sampling Locations



Circle colors indicate zone (red-LSZ, blue-UWBZ, black-CZ)

Site ST012 June New EBR Well Sampling Locations



Circle colors indicate zone (red-LSZ, blue-UWBZ, black-CZ)

Conceptual Long-Term EBR Schedule

Site ST012 EBR Schedule

- Phase 1 EBR**
  - Drilling and Construction — May-Aug 2016
  - Injections — Sep-Nov 2016
  - Monitoring — Sep 2016-Aug 2017
- Phase 2 EBR** (conceptual)
  - Planning — Apr 2017-May 2017
  - Implementation — Jun 2017-Aug 2017
  - Monitoring — Sep 2017-Aug 2018
- Phase 3 EBR** (conceptual, if necessary)
  - Planning — Apr 2018-May 2018
  - Implementation — Jun 2018-Aug 2018
  - Monitoring* — Sep 2018-Aug 2019

*Could transition to additional EBR phases if needed

**The schedule may be expedited in certain locations based on results from drilling and monitoring results in each phase